

A Comparative Clinical Evaluation on Three Maxillary Nerve Block Techniques of Local Anesthesia in Minor Oral Surgery

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الخلاصة

الأهداف: تهدف الدراسة إلى مقارنة ثلاث طرائق لتخدير عصب الفك الأعلى فيما بينها عند استخدامها في عمليات جراحة القم الصغرى لأسنان الفك الأعلى. **المواد وطرائق العمل:** تم إجراء البحث في فرع جراحة القم والوجه والفكين / كلية طب الأسنان / جامعة الموصل. كان اختيار المرضى على أساس حاجتهم إلى عملية جراحية صغرى سيتم إجرائها على أسنانهم العلوية (الأمامية أو الخلفية). تم تقسيم العينة إلى ثلاثة مجاميع اعتماداً على طريقة التخدير المستخدمة، المجموعة الأولى (عينة الضبط): طريقة التخدير المستخدمة في هذه المجموعة هي طريقة تخدير العصب الخلفي العلوي السنجي. المجموعة الثانية: طريقة التخدير المستخدمة في هذه المجموعة هي طريقة تخدير عصب أسفل مجهر العين. المجموعة الثالثة: طريقة التخدير المستخدمة في هذه المجموعة هي طريقة تخدير عصب الفك العلوي الرئيس. لغرض المقارنة بين الطرائق، تم اختيار المتغيرات التالية: سحب الدم الموجب قبل الحقن، بداية التخدير الجراحي المطلوب لإجراء العملية و مقياس الشعور بالألم أثناء العملية الجراحية. **النتائج:** بالنسبة للمتغير سحب الدم الموجب قبل الحقن: أظهرت النتائج عدم وجود اختلافات معنوية بين المجاميع. بالنسبة إلى المتغير بداية التخدير الجراحي المطلوب لإجراء العملية، أظهرت النتائج عدم وجود اختلافات معنوية بين المجاميع الثلاثة. بالنسبة إلى المتغير مقياس الشعور بالألم أثناء العملية الجراحية، أظهرت النتائج عدم وجود اختلافات معنوية بين المجاميع الثلاثة. **الاستنتاجات:** أن طريقة تخدير عصب الفك العلوي الرئيس هي طريقة آمنة وفعالة لتخدير نصف الفك العلوي طالما أن هناك التزاماً تاماً ومعرفة بتشريخ المنطقة وبخطوات الطريقة نفسها. أن هذه الطريقة تحمل معها نسبة نجاح عالية وإذا ما تم استخدامها في حالات معينة، فإنها تمنح طبيب الأسنان فترة تخدير جيدة أثناء علاج أسنان المريض.

ABSTRACT

Aims: To compare three maxillary nerve block techniques of local anesthesia in terms of success during minor oral surgical procedures on maxillary teeth. **Materials and Methods:** The clinical trial was conducted at the Department of Oral and Maxillofacial Surgery/ College of Dentistry/ Mosul University. The subjects enrolled in the trial required surgical procedures on their upper anterior and / posterior teeth. The sample included 60 subjects who were divided into three groups of 20 each; Group I (control I) patients who were to receive the posterior superior alveolar nerve block technique. Group II (control II) patients who were to receive the infraorbital nerve block technique and Group III (control III) patients who were to receive the maxillary nerve block technique of local anesthesia. For comparison, the following variables were recorded for the three techniques: Positive aspiration, onset of adequate surgical anesthesia and pain grade scale during surgical procedure. **Results:** In regard to positive aspiration before injection of solution, the results showed no significant difference regarding positive aspiration among the three techniques. For onset of adequate surgical anesthesia, the results disclosed no significance difference in mean duration of onset of anesthesia among the three groups. In regard to pain experienced during the surgical procedure, no significant difference was recorded among the three groups. **Conclusions:** The maxillary nerve block technique via the high tuberosity approach seems to be a safe and effective technique for achieving anesthesia of the hemimaxilla as long as there is strict adherence to the anatomical landmarks and approach described. The technique carries with it a high success rate and with specific applications can allow the dentist to provide painless dental treatment. **Key Words:** Maxillary nerve block techniques, Maxillary anesthesia, Local anesthesia.

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INTRODUCTION

Over the past few years, the dental industry has introduced a number of local anesthetic delivery systems (Stabident, X-

tip).⁽¹⁾ Conventional needle and syringe procedures however remain the cornerstone of local anesthesia for most dentists. Most of these "tried and true" approaches

are both popular and easy to administer for the dental practitioner since they are widely taught in undergraduate dental curriculum.⁽²⁾ There is one technique, however, that although relatively safe, effective and reliable, is little mentioned in undergraduate dental programs. This technique, the maxillary nerve block technique, provides the patient profound anesthesia of the maxillary branch of the trigeminal nerve that allows the dentist to perform procedures anywhere in the maxillary quadrant that has been anesthetized.^(3,4) This technique seldom employed for restorative dentistry but can be of benefit when extensive maxillary surgery is to be planned.^(5,6) The basic concept of this approach is to deposit a sufficient amount of local anesthetic solution close to the maxillary nerve as it passes through the pterygopalatine fossa.^(7,8) Three approaches to reach this region have been described in the literature: one extraoral⁽⁹⁾ and intraoral approaches. The two intraoral approaches are either through the pterygopalatine canal⁽²⁾ or the lateral or so called high tuberosity approach.^(5,6) The major difficulty in the pterygopalatine canal approach is in locating and negotiating the canal successfully.^(4,10,11) The alternative high tuberosity approach is perhaps a more accessible injection and is sometimes required when the pterygopalatine canal cannot be easily negotiated with the needle yet the technique may be associated with hematoma.^(2,6)

The aim of this clinical trial was to evaluate the high tuberosity approach for achieving anesthesia of the maxillary nerve and to compare it with two common maxillary nerve block techniques based on certain criteria.

MATERIALS AND METHODS

The clinical trial was conducted at the Department of Oral and Maxillofacial Surgery/ College of Dentistry/ Mosul University. The sample comprised of sixty (60) patients of both genders and of ages ranging from 20–39 years.

Inclusion criteria were as follows:

1. Medically fit patients.
2. The patient had no previous history what so ever to any allergic reaction to the local anesthetic solution that was to be

administered.

3. No clinical evidence of acute inflammation at the injection site and area of intended surgery.

4. For the purpose of comparison, the posterior superior alveolar nerve and infraorbital nerve block techniques were considered as controls. Hence the sample was divided into three groups:

5. Group I: Which comprised of twenty (20) subjects who were to receive the posterior superior alveolar nerve technique.

6. Group II: Which comprised of twenty (20) subjects who were to receive the infraorbital nerve technique.

7. Group III: Which comprised of twenty (20) subjects who were to receive the maxillary nerve block technique.

The dental procedures carried out were as followed:

1. Multiple extraction of molar teeth in 12 subjects.

2. Extractions of two premolar teeth in 10 patients.

3. Surgical removal of impacted wisdom molar tooth in 8 subjects.

4. Surgical closure of oroantral communication in 3 subjects.

5. Upper first molar apicectomy in 8 patients.

6. Apicectomy procedures in the upper anterior teeth in 10 subjects.

7. Apicectomy procedures on the upper premolar teeth in 9 subjects.

The purpose of the trial and possible complications of techniques (mostly hematoma formation) as well as the wide area of anesthesia expected following a maxillary nerve block injection (group III) were explained to the patient and after approval the trial was commenced.

Each subject in each group was to receive a standard volume of 1.8 ml local anesthetic solution (2.2 ml of Lignocaine 2% with 1:80,000 adrenaline – Septodont – Made in France of standard expiry date) for the nerve block technique and an additional 1ml of local anesthetic solution locally (infiltration) i.e. a total volume of 2.8 ml of solution for each technique. The latter injection was limited to procedures that required flap reflection.

The basic steps of the lateral or high tuberosity approach of the maxillary nerve block are similar to the posterior superior

alveolar nerve block technique of local anesthesia: the patient is seated in a comfortable semisupine position with mouth partially opened: the cheek is retracted with a mirror and the site of injection is wiped with a pellet of cotton soaked with antiseptic solution (Chlorhexidine mouthwash 0.12%–Biofresh–Made in Syria) rolled on the tip of a tweezers. The tip of dental needle (32 mm length–gauge 27–1Shot– Made in Korea) loaded on a conventional aspirating dental syringe (Astra–Made in Austria) is inserted slightly above the apex of the distobuccal root of the upper second molar at a 45 angle to the long axis of the that tooth: the needle with its tip bevel facing bone is advanced slowly upwards, backwards and inwards to reach its target area above and posterior to the maxillary upper third molar close to the pterygomaxillary fissure. Depth of needle insertion is (2.5–3 cm) when compared to only 16mm depth of needle insertion in the posterior superior alveolar nerve block technique (in an adult of normal size). This depth is mandatory to reach the area of the pterygopalatine fossa.^(5,6) On reaching the target area, aspiration is carefully performed and if negative, the solution is slowly deposited at a rate of 1ml/minute. In this technique, the patient will experience a sensation of pressure in the area of injection but this was transient and will fade once anesthesia begins. For the two control groups, an additional few drops of anesthesia were deposited palatally. Onset of anesthesia was assessed by the absence of pain sensation on deep pressure probing of the soft tissue overlying the tooth or teeth that were to be operated on (both buccally and palatally). This was recorded as accurate as possible in minutes and seconds using a stopwatch (Made in England). For the purpose of standardization, a time of ten minutes had to elapse before surgery was carried out. All injections but

not necessarily all surgical procedures were performed by a single surgeon to avoid operator – mediated errors.

For comparison, the following data were recorded:

1. Positive were aspiration.
2. Onset of surgical anesthesia.
3. Pain grade scale during surgery.

Pain grade scale during the surgical procedure was evaluated according to the Dobb and Devier System.⁽¹²⁾

1. Grade A anesthesia: No pain entirely on surgery
2. Grade B anesthesia: Mild to moderate pain but was tolerable to the patient.
3. Grade C anesthesia: Severe intolerable pain with additional anesthesia necessary.

The statistical analysis used was SPSS program in Pent.4 computer. The ANOVA test was used to evaluate significance in regard to onset of surgical anesthesia among the three groups. Means were significant if $p \leq 0.05$. The Kolmogorov–Smirnov test was used to evaluate the pain grade scale during surgical procedure among the three groups.

RESULTS

The number of patients who participated in the clinical evaluation was 60: 42 males and 18 females with ages ranging from 20 to 38 years. The average age of these patients was 29.4 years. The number of surgical procedures performed with a range of their duration and technique of anesthesia administered is shown in Table (1). Before the deposition of solution, aspiration was carried out for each technique. In group I, positive aspiration was recorded in 20% of subjects (4 patients). In group II, positive aspiration was disclosed in 10% of subjects (2 patients). In group III, 25% of positive aspiration was recorded (5 subjects).

Table (1): Type of surgery with range of duration and techniques of anesthesia administered.

Type of surgery	Gp I	Gp II	Gp III	Duration (min)	No.
Molar extraction (multiple)	10	————	2	1–6	12
Premolar extraction (multiple)		10		1–4	10
Surgical removal of upper wisdom tooth	5		3	3–15	8
Closure of oroantral Fistula	1		2	25–45	3
Apicectomy of upper first molar	4		4	25–40	8
Apicectomy of the upper premolars (one or both)	————	5	5	25–40	10
Apicectomy of the upper anterior teeth		5	5	20–35	10
Total	20	20	20		60

Group I: Posterior superior alveolar nerve block (PSA); Group II: Infraorbital nerve block (IOB); Group III: Maxillary nerve block (MNB). No: number of procedures.

For onset of adequate surgical anesthesia, the results showed that the mean onset of action in group I was 186.4 seconds, in group II, 179.2 seconds while in

group III, 243.8 seconds. No statistical significance was disclosed among the three groups. This is shown in Table (2).

Table (2): Analysis of variance for onset of surgical anesthesia among the three groups.

Group	No.	Mean ± SD	F value	p value	Duncan's grouping
I	20	186.4 ± 16.7			A
II	20	179.2 ± 13.6	1.5	0.231	A
III	20	243.8 ± 222.5			A

In regard to pain score level during surgery among the three groups, The results were as followed:

1. Grade A: This was recorded in 16 subjects (80%) in group I whereas in 14 (70%) subjects in group II and 17 (85%) of patients in group III.

2. Grade B: This was recorded in 4 (20%) of subjects in group I and in 6 (30%) subjects in group II and in 3 (15%) subjects in group III.

No statistical significant difference was disclosed in this regard among the three groups. This is shown in Table (3).

Table (3): Pain grade scale during surgical procedure for each technique of anesthesia administered.

Grade of pain	Group I	Group II	Group III
Grade A	16	14	17
Grade B	4	6	3
Grade C	nil	0	0
Total	20	20	20

Kolmogorov–Smirnov test: Z= 0.612; D (absolute)= 0.204. p–value = 0.847 (not significant).

DISCUSSION

The main objective of this clinical evaluation was not just to compare the maxillary nerve block in terms of success rate with the aforementioned techniques (posterior superior alveolar and infraorbital nerve block injection techniques), but

also to show the dental practitioner the relative ease and effectiveness of this technique when indicated. Yet however as with any other anesthetic technique, thorough and sound knowledge of the anatomy of the region is mandatory. This is very important in the maxillary nerve block

since the area of injection is in the infratemporal fossa is rich in vascular and nerve supply.⁽⁶⁾ The main point of concern in this technique is the risk of hematoma formation if aspiration is not carried out before injection as the main branches of the maxillary artery as well as the pterygoid plexus of veins are located there.^(5,7,9) This was carried out in this clinical evaluation where the results disclosed a 25% positive aspiration. Intravascular injection was avoided by redirecting the dental needle until negative aspiration was achieved. In general, the main advantage of this technique includes the ability to do quadrant dentistry without multiple injections (only a single injection) and is usually best for extensive surgical procedures requiring a wide area of local anesthesia.⁽⁷⁾ Yet for achieving haemostasis, local infiltration may be indicated. This was true for open flap surgery in the clinical trial conducted (19 patients). In addition, this is also necessary in the area of midline where there is contra-lateral innervations from the opposite quadrant.⁽⁵⁾ This was true in the clinical trial in two cases of apicectomy on the upper anterior teeth (two contra-lateral central incisors involved in the lesion), one in the infraorbital group and another in the maxillary nerve group. As with any other nerve block injections, this technique bypasses the area of acute inflammation if present since the site of injection is faraway and thus not disseminate an infection in or around the involved area.^(2,13) Schwartz *et al.*,⁽¹⁴⁾ in a clinical study evaluated the maxillary nerve block technique using a computer controlled local anesthetic delivery system for maxillary sinus elevation procedures. Their evaluation suggested that when indicated, this technique should be adopted with ease and confidence. Okuda *et al.*,⁽¹⁵⁾ used computed tomography to aid in the administration of this technique. The results of their clinical evaluation concluded that there is total sensory loss in the area innervated by the maxillary nerve and did so without complications. This was true in 85% of subjects in patients who received the maxillary nerve block in the current trial who did not experience any pain during surgery. Malamed⁽⁶⁾ reported a 95% of success rate. The most important concern

to the patient in this technique is the wide area of anesthesia achieved which was bothering to some (12 patients) while 8 patients felt comfortable psychologically. Finally, with frequent and knowledgeable use, this technique may become a valuable aid in the anesthetic protocol.

CONCLUSIONS

The maxillary nerve block technique via the high tuberosity approach seems to be a safe and effective technique for achieving anesthesia of the hemimaxilla as long as there is strict adherence to the anatomical landmarks and approach described. The technique carries with it a high success rate (85% in this trial) and with specific applications can allow the dentist to provide painless dental treatment.

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